

25. Note on the Dipterous Bat-Parasite *Cyclopodia greeffi* Karsch, and on a new Species of Hymenopterous (Chalcid) Parasite bred from it. By F. W. URICH (Government Entomologist, Trinidad, B.W.I.); HUGH SCOTT, M.A., Sc.D., and J. WATERSTON, D.Sc., F.Z.S.

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(Text-figure 1.)

I. INTRODUCTORY REMARKS: by HUGH SCOTT.

The Nycteribiidae are a family of wingless, pupiparous Diptera of bizarre form, parasitic exclusively on bats. A tolerably complete summary of what is known as to their biology will be found in a paper by the writer in 'Parasitology' (Cambridge), vol. ix., no. 4, p. 593, 1917. The only species whose life-cycle has been at all completely studied is the one which is the subject of this present note, *Cyclopodia greeffi* Karsch (= *C. rubiginosa* Bigot: see Scott, *op. cit.* p. 596, footnote). Its life-history was described in a valuable paper by Rodhain and Bequaert, "Observations sur la biologie de *Cyclopodia greeffi*," Bull. Soc. Zool. France, vol. xl., nos. 8-10, pp. 248-262, 1915. An abstract of this work formed a large part of the writer's summary in 'Parasitology,' referred to above.

Cyclopodia greeffi was originally described (1884) from the island of San Thomé and the adjacent islet of Rolas, its host being the flying-fox *Eidolon helvum* Kerr (= *Cynonycteris straminea* Geoffroy)*. It was further described (1891), under the name *C. rubiginosa*, by Bigot from Assinie on the Guinea Coast (host not stated). The Imperial Bureau of Entomology submitted to the writer 9 ♂ and 4 ♀, now recorded for the first time, from Ossidinge, Cross River, Cameroons (A. W. Pomeroy coll., l. xi. 1915, from a large bat of undetermined species); and Monsieur E. Roubaud sent for determination in 1916 a single ♂ from Agouagon, Dahomey (host not exactly named). Rodhain and Bequaert made their observations at Leopoldville, Belgian Congo, the host being *Eidolon helvum*.

In 1920 Mr. F. W. Urich, being in Europe on leave from Trinidad, went on a mission to San Thomé. There he rediscovered *Cyclopodia greeffi* on its original host-species of bat, not only finding adult examples on the bats, but breeding specimens from the puparia.

Mr. Urich also bred two examples of a Chalcid hyperparasite from two of the Nycteribiid puparia. These are described below by Dr. Waterston as a new species of *Eupelmus*. They

* Karsch, Sitzb. Ges. Beförd. ges. Naturwiss. Marburg, 1884, p. 77. See also Speiser, Arch. Naturg. 67. i. 1901, pp. 54, 65.

are of quite special interest, as they are (so far as the writer knows) the first insect hyperparasites of any kind recorded from Nycteribiidæ*. The *Eupelmus* belongs to a group some members of which are parasitic on scale-insects (Coccidæ), and it is remarkable that the puparia of the *Cyclopodia* themselves bear a very strong superficial resemblance to certain scale-insects which are parasitised by other forms of *Eupelmus*.

As regards the bionomics of the *Cyclopodia*, Mr. Urich's observations confirm certain of those of Rodhain and Bequaert. He mentions the agility of the movements of the parasites, when disturbed, on the bodies of their hosts—a fact which has been noted also concerning other species of Nycteribiidæ. These insects are, as stated above, "pupiparous," i. e. the females give birth to full-fed larvæ, the integument of which immediately hardens and darkens to form the puparium. It appears that some species of Nycteribiidæ attach their larvæ to the bodies of their hosts (see Scott, 'Parasitology,' t. c. p. 598), but in *Cyclopodia greiffi* this is not the case. The females of this species attach their larvæ to parts of the trees in which the bats have their sleeping-places. Rodhain and Bequaert made their observations on bats in captivity, and the majority of the Nycteribiid larvæ were fixed to the undersides of wooden perches in the cages: these authors think that in a wild state the larvæ are probably attached to the smooth trunks or branches of *Dracena*-trees, which are the favourite sleeping-places of the bats near Leopoldville. In San Thomé Mr. Urich found the puparia fixed to the upper and lower surfaces of the smooth leaves of certain dicotyledonous trees (name not stated) in which the bats slept.

Rodhain and Bequaert describe how the female *Cyclopodia* with the undersides of their bodies press their larvæ down on to the substratum, to which the larva firmly adheres. It immediately assumes the shape of, and hardens and darkens to form, the puparium. This is a half-ellipsoidal body, with elliptic contour, rather narrower behind, convex dorsally and quite flat ventrally, where it is "glued" to the substratum. Its dorsal and ventral surfaces are separated by an angular margin. The dorsal surface becomes uniformly black, and the resemblance of the puparium to a black scale-insect (such as *Saissetia oleæ*) is at first sight very great, though with closer examination traces of segmentation and the position of the two pairs of larval spiracles are discernible. The puparium is figured by Rodhain and Bequaert, *op. cit.* p. 258.

The flat ventral surface of the puparium remains colourless and transparent, and if pupæ are detached from their substratum various phases in the development of the enclosed nymph can be

* As regards other organisms hyperparasitic on Nycteribiidæ, the latter sometimes bear on their bodies Laboulbeniaceans fungi: see Speiser, *Arch. Naturg.* 67. i. 1901. p. 29; Scott, *Arch. Naturg.* 79. A. 1913, Heft 8, p. 96 (1914), and *Ann. Mag. Nat. Hist.* (8) xiv. p. 234 (1914).

observed through this ventral transparent covering. In the material sent by Mr. Ulrich several stages can be seen, including a fully-formed adult nearly ready to emerge from the puparium.

Sufficient has now been written to introduce Mr. Ulrich's own report of his observations.

II. OBSERVATIONS IN SAN THOMÉ IN 1920: by F. W. URICH.

The host of the *Cyclopodia* was the flying-fox *Eidolon helvum* Kerr (= *Cynonycteris straminea* Geoffr.), which was common and numerous in the north-western part of the island of San Thomé. These flying-foxes seem to have established themselves in the woods situated near Morro Mogueingui (about 3 miles from the sea)—at least, that is where they passed the day. Every evening, as soon as the last rays of the sun disappeared, they sallied out in thousands. They all flew towards the interior, those going far kept very high and the others whose objective was near by just kept above the tree-tops; in the morning just before sunrise, between 5 and 6, they could be seen returning to their sleeping quarters. Their food consisted principally of the ripe fruit of the papaya, *Carica papaya*, which grew wild all over the island. At the island of Principé, where the same species of flying-fox occurs, I was told that they attacked cacao pods, papaya not being so common there. The trees selected for sleeping were very tall and slender-stemmed, and the flying-foxes were settled so close together that two shots from a fowling-piece brought down 20 specimens. This roosting-place was known to be used for years, and the small branches of the trees showed very old scars and scratches from the flying-foxes' claws; the ground under the trees was covered with young papaya seedlings, and a peculiar acrid odour from accumulated excrement prevailed under the trees*. The dead specimens were put into cloth bags as quickly as possible to prevent the escape of any Nycteribiid; the parasites moved about quickly on the bodies of their hosts, but I did not observe any actually darting about. The leaves of the trees used for roosting were dotted with numerous puparia. A hundred leaves collected at random showed 61 puparia on the top surface and 96 underneath. The leaves were smooth on both surfaces. The skin of the larva must dry and harden very quickly; dead specimens were placed in cloth bags at about 2 p.m., and four hours after two fully hardened and coloured puparia were found sticking to the cloth. [Rodhain and Bequaert, *op. cit.* p. 257, state that the hardening and darkening process is complete in 20-30 minutes after the birth of the larva.]

* [Habits not unlike those here described have been noted among various kinds of large fruit-eating bats by other observers. *E. g.*, in the Seychelles the local flying-foxes (*Pteropus* sp.) have regular sleeping-places in particular clumps of trees, and "Camp Chauve-Souris" has become a place-name in at least one island (Silhouette). In Mahé (1908) the bats might frequently be seen in numbers passing northwards along the west coast of the island at sunset, on their way (it was said) from one of their "camps" to their feeding-grounds, which were said to be places where bread-fruit and other fruit trees were plentiful.—H. SCOTT.]

No larvæ or puparia were found on the flying-foxes. Newly emerged adult specimens, kept in cloth bags with leaves, died after 48 hours and never assumed the full coloration. When placed on the skin of a rabbit they made feeble attempts as if to feed, but desisted after a short time. [Rodhain and Bequaert found that specimens newly-emerged from puparia cannot survive more than 48 hours unless they find a host; and that examples removed from their host-bats could not be induced to feed and very soon died.]

Two examples of a hymenopterous hyperparasite issued, one from each of two puparia. In emerging they made a rather jagged-edged hole in the dorsal surface of the puparium. They are described below by Dr. Waterston.

III. A NEW *Eupelmus* (*E. urichi*, sp. n.) FROM SAN THOMÉ:
by JAMES WATERSTON.

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The species now described might well, owing to its antennal and thoracic peculiarities, be made the type of a new genus. I do not propose to take this step however, partly because it is not yet clear how far the coalescence of funicular joints can be relied upon for systematic purposes, but chiefly because only one sex is at present available for study.

It should be noted in connection with the colour characters given below, that the specimens studied had been in alcohol for some time before mounting. It is likely that they now appear to be somewhat duller than in life.

EUELMUS URICHI, sp. n.

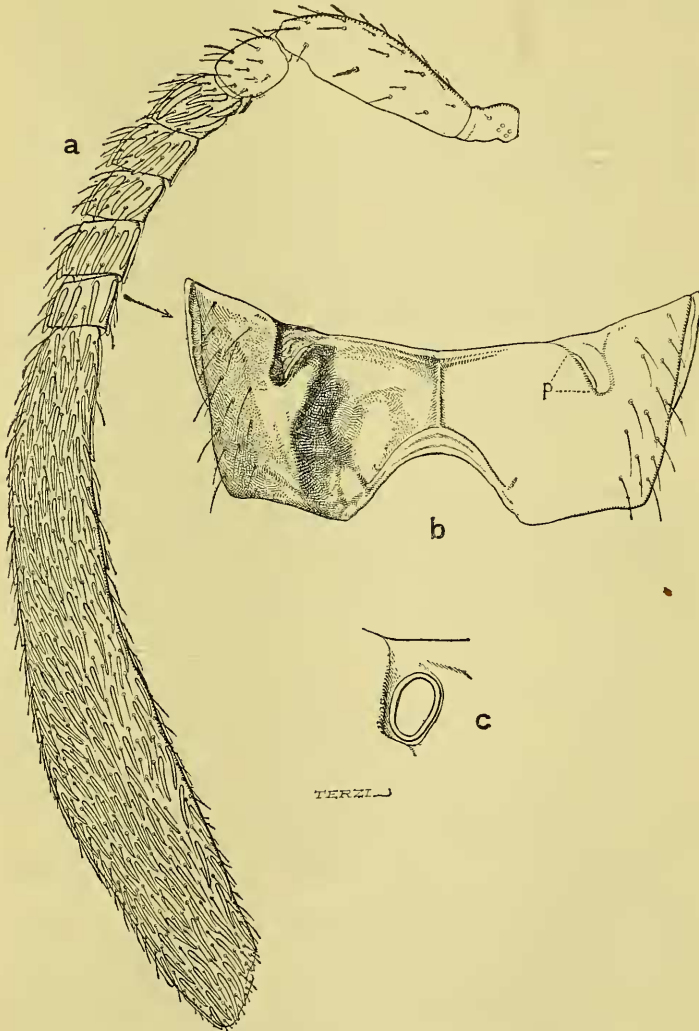
♂. A blackish-brown to nearly black species with the following parts more or less pale ferruginous: scape (except at tip), mandibles (dental apices dark), all trochanters, knees of fore and mid legs and tibial apices of the same, and tarsi except for the 5th joint in fore and 4th and 5th of mid and hind legs which are more or less infuscated. Metallic lustre, only distinctly showing on propodeon and dorsum of abdomen, reflections on head and thorax faintly æneous, more distinctly purplish green on propodeon and base of abdomen.

The wings, especially the fore pair on distal half, are distinctly infuscated, with the veins still darker.

Head (15:13): mouth opening half as broad as head; the eyes are bare and occupy two-thirds of the depth. At their nearest separated by five-twelfths of the breadth. Toruli just above the base line of the eyes. The shallow straight-edged clypeal emargination is in length subequal to the distance between the toruli. Except in the scapal grooves, the entire frons and face have a moderately fine distinctly raised sculpture, the surface being dull, with very numerous short, stiff bristles, of which two (1:1) above the corners of the clypeal emargination are longer.

The toruli at their nearest (superiorly) are separated by about the long diameter of either and basally by about two diameters. They stand from the orbits four-fifths of a diameter.

Text-figure 1.



Eupelmus urichi, sp. n. ♂:—*a*, antenna; *b*, propodeon (*p*, upper edge of peritreme); *c*, spiracle at its greatest length and breadth seen from the direction indicated by the arrow.

Antenna: length 1.25 mm. (see text-fig. 1), consisting of scape, pedicel ring joint, five normal funicular joints and a large sausage-like club (consisting of two funicular and three normal club segments fused).

Mouth parts.—Labrum (3 : 2) with convex edge and five stout fringing bristles of which the longest equals the breadth of the sclerite. Mandible (4 : 3) bidentate, the upper tooth smaller and rather abruptly and obliquely truncated superiorly. Stipes smooth, about a dozen bristles. Max. palp. (measured along outside edge) 11, 12, 15, 36. In same ratio the breadth of joints 1-3 is about 10 and of 4, 15. Terminal bristles of 4th about half the length of that joint which bears also 10 stout bristles on apical half and about 20 finer more generally distributed. Labial palpus 15, 9, 15 with a breadth at the joints of 12-14. Apical bristles distinctly longer than third joint which bears also about a dozen other bristles mainly stout. There are no fewer than 10 (5 : 5) setigerous cells on the lingua.

Thorax.—Pronotum, in two separate rhomboidal sclerites each with the inner anterior angle rounded off. The outer anterior angle is weakly chitinized. The postero-lateral angle is folded down enclosing the spiracle. Each sclerite bears (mainly on the posterior half) about 50 stiff bristles of which 6-8 stand along the hind margin between the mid line and the spiracle. Prosternum, bristles (8-9 : 8-9). Prothoracic surface generally nearly smooth, duller and raised reticulate at the sides in front of the spiracle. Mesonotum very broad, only a little longer (7 : 6) than wide, divided almost equally by the transverse suture, the scutellum and axillæ being relatively large. Parapsidal furrows deep, mid lobe (measured with the prothorax removed) just longer than the scutellum. The intercept of the parapsidal furrows on the transverse suture (4 times the narrow base of the scutellum) occupies rather over one-third of the breadth. The pattern on the mid lobe is moderately coarse and raised; of the parapsides and axillæ a little lower, while the scutellum is nearly smooth with over 40 bristles equally distributed about a bare mid line. Before the suture the surface is densely bristly and there are about a dozen on each axilla. These notal bristles are a little longer posteriorly with six (3 : 3) above the hind edge of the scutellum distinctly stronger than the others.

Metathorax.—All over finely reticulate, pattern hardly raised, the three regions well defined. Mid area posteriorly crenulate, lateral areas with one bristle each.

Propodeon smooth with strong reflections, contoured as in text-fig. 1, shortly rugose round the insertion of the petiole. With a delicate percurrent mid line but no keel. Spiracle facing anteriorly and outwards, only the edge of the peritreme visible from above. There are about 15 bristles behind and beyond the spiracle.

Mesosternopleuræ nearly all smooth, the only indications of a raised pattern being on the prepectus (posterior half) and in

front of the femoral furrow where there are 12–15 bristles. About the same number stand in a triangular area on the mesosternum posteriorly and there are one or two more at the sides.

Forewings: length 1.3 mm., just over twice as long as broad, submarginal, radius, postmarginal, 21 : 13 : 5 : 10, submarginal 13 bristles. Radius, 4 on stalk and 10 on club.

Legs robust. Fore-legs: femur (45 : 15), tibia (32 : 7) with three peg-like apical spines or teeth, tarsus 52, 32, 24, 20, 28. Mid legs: femur (nearly 5 : 1), slightly shorter (14 : 15) than the tibia (15 : 2), spur as long as 1st tarsal joint, tarsus 51, 36, 27, 21, 28. Hind-legs: coxa long, $\frac{3}{4}$ the femur (7 : 2). Tibia (5 : 1) apical comb 12–14 spines; longer of the two spurs not $\frac{1}{2}$ the 1st tarsal joint. Tarsus 68, 38, 27, 21, 28. All legs densely set with bristles.

Abdomen smooth. 1st (3rd) tergite shortly incised on posterior edge, more heavily chitinized antero-medianly (basally) with traces of sculpturing on the thickened area. Other tergites simple, transverse and entire. Spiracle minute, circular. Stylet very short, 5 bristles. The petiole ventrally shows two chitinous ridges. The sternites show a median weakly chitinized line. Entire ventral surface very bristly.

Length about 2.3 mm.

Expanse about 3.2 mm.

Type ♂ (dissected on slide) in British Museum, one of two ♂ reared ex puparia of *Cyclopodia greeffi* Karsch, a Nycteribiid parasite of the flying-fox *Eidolon helvum* Kerr (*Cynonycteris straminea* E. Geoffr.). W. Africa, San Thomé, Oct. 1920. F. W. Urich coll.